REMR TECHNICAL NOTE CS-ES-1.3

ULTRASONIC SYSTEM FOR RAPID ASSESSMENT OF SOUNDNESS OF SHEET PILE AND OTHER FLAT STRUCTURES

PURPOSE: To provide information on an ultrasonic system for use in nondestructive testing of sheet pile structures.

APPLICATION: Performing rapid nondestructive tests of sheet pile structures in place. The system involves using an ultrasonic instrument to measure the thickness of the sheet piling, based on which the rate of metal loss can be computed.

ADVANTAGES: The test is nondestructive and can be easily and rapidly performed. Even inexperienced personnel can be trained to use the instrument with reasonable accuracy in less than 15 minutes. If the instrument is connected to a minilogger (microprocessor), both the measurements and the recording of data can be accomplished by one individual. Access to only one face of the structure is required. The test could also be used underwater if necessary.

LIMITATIONS: To achieve good contact to the ultrasound device, it may be necessary to clean the surfaces of the sheet piling to be tested to provide a clean metal surface for ultrasonic thickness measurements.

AVAILABILITY: The Construction Engineering Research Laboratory (CERL) maintains the instruments and expertise needed to perform ultrasonic thickness measurements of sheet pile structures. CERL will work with any Corps of Engineers' Division or District office that desires to evaluate this type of system prior to purchasing one for its own use. Nondestructive testing of sheet pile structures is also performed by a number of private contractors. If a contractor is hired to perform such testing, he should be certified by the American Society for Nondestructive Testing.

COSTS: Costs will be job-specific, depending on such factors as the amount of sheet piling to be tested, on-site support furnished to the inspection team, whether the work is performed by Corps personnel or by a contractor, and travel and related expenses. A contractor normally charges $30 to $35 per hour for one inspector to perform ultrasonic measurements. The costs of an ultrasonic measuring instrument is about $1,700, and the cost of a microprocessor unit (for one-man inspections) is approximately $2,000, not including the costs of cable and transducers.

FIELD EXPERIENCE: An ultrasonic system was used by Corps personnel to estimate how long the sheet pile structural system of the walls of the T. J. O'Brien Lock and Dam, located on the Illinois Waterway, Chicago, Illinois, would function satisfactorily without major repairs. While the lock was dewatered for maintenance, repair, and painting, an inspection team from CERL performed an ultrasonic inspection of the sheet pile structures. The lock

walls, guide walls, and dam were constructed from marine steel interlocking sheet piles. Portions of the sheet piles were sandblasted, after an analysis of the various corrosion formations, to provide a clean metal surface for ultrasonic thickness measurements. Measurements were made starting 1 ft from the top of the cell and continuing down to the bottom, 13 ft below the top of the cell. Given the remaining thickness of the sheet piling, the loss of metal could be determined. The loss of metal was divided by the time involved for this loss to occur, and an average corrosion rate in thousandths of an inch or mils per year was obtained. The inspection team consisted of two individuals, one to perform the ultrasonic inspection and make pit measurements, and the other to record the location and data. Other factors considered during this inspection were soil resistivity measurements, effluents that were seeping in from the land side of the lock, and water quality (corrosivity of the river water). A continuous and instantaneous corrosion rate monitoring system was installed to determine whether any cyclical changes in the corrosivity of the water flowing in the lock had occurred. Pit measurements were made of all pits to establish the pitting factor for the lock walls. Laboratory tests were performed by CERL on several test sheet piles that were buried adjacent to the lock wall, and tensile tests and structural analyses were made on the rusted and pitted areas to determine loss of strength of the interlocks. Also, a cathodic protection system was designed for the protection of the sheet piling and guide walls by the inspection team.

DESCRIPTION: Ultrasonic measuring instruments are available which have touch controls and microprocessor-based operation. The measuring instrument weighs about 11 ounces and can be connected to another microprocessor (called a minilogger) that can store 2,700 location points and measurements. After the inspection or at the end of a work shift, the minilogger is hooked up to a commercial printer, and the location or test number and measurement data can be easily printed for evaluation and reports.